

# A New Web Based System to Evaluate Workers Exposure According to Requirements of the Directive 2004/40/EC

*H. Molla-Djafari<sup>(1)</sup>, D. Leopold<sup>(2)</sup>, B. Petric<sup>(3)</sup>, G. Neubauer<sup>(2)</sup>*

(1) Austrian Workers' Compensation Board, A-1200 Vienna, Austria  
[hamid.molla-djafari@auva.at](mailto:hamid.molla-djafari@auva.at)

(2) Austrian Institute of Technology GmbH, A-2444 Seibersdorf, Austria,  
[georg.neubauer@ait.ac.at](mailto:georg.neubauer@ait.ac.at), [doris.leopold@ait.ac.at](mailto:doris.leopold@ait.ac.at)

(3) Seibersdorf Laboratories GmbH, A-2444 Seibersdorf, Austria  
[benjamin.petric@seibersdorf-laboratories.at](mailto:benjamin.petric@seibersdorf-laboratories.at)

## Abstract

The Directive 2004/40/EC of the European Commission has the purpose to protect workers against adverse affects arising from electromagnetic fields. To achieve this goal several requirements are imposed on employers that can be hardly managed by them mainly due to their lack of expertise in the field of electromagnetic fields. It was therefore decided to develop a software system called EMES dedicated to enable employers to evaluate the exposure of their employees without having any expertise in the field of electromagnetic fields. The exposure arising from all selected sources is then calculated and compared to the limits given in the Directive 2004/40/EC.

## 1. Introduction

The Directive 2004/40/EC [1] of the European Parliament and the Council lays down minimum health and safety requirements regarding the exposure of workers to the risk arising from physical agents (electromagnetic fields). Among several other requirements the Directive states that employers should make adjustments in the light of technical progress and scientific knowledge regarding risks related to exposure to electromagnetic fields, with a view to improving the safety and health protection of workers. The Directive defines a number of obligations of employers, including the determination of exposure by competent services or persons in adequate intervals, evaluation if limits are exceeded and provision of a risk assessment. Taking into account the fact that the vast majority of employers is not familiar with electromagnetic fields and exposure evaluation, most employers are not in the position to fulfil the requirements set up in the Directive 2004/40/EC. This situation is also reflected by the outcome of a consultation of European social

partners performed by the European Commission in 2010 [2]. The majority of the social partners were not satisfied with the Directive, employers' organisations regarded the Directive as inappropriate because it is difficult to implement. Nevertheless they considered a community initiative as the best way to ensure a high standard of protection of workers. In this light the European Commission decided to revise the current revision, a process that was ongoing when this paper was written in February 2011. Taking these developments into account we decided therefore to develop a web based software system in Austria. The idea and methodology were developed by the Workers Compensation Board, software development and exposure assessment by the Austrian Institute of Technology and Seibersdorf Laboratories. The goal of the system is to enable employers to evaluate the exposure of their workers based on sound measurements and calculations and not on subjective appraisals without any specific knowledge on electromagnetic fields and exposure assessment. This approach gives employers also legal certainty.

## 2. Methods

The basic idea of the newly developed system called EMES (Electro Magnetic Evaluation System) is the selection of specific electromagnetic sources at working places by the employer or his representative using a software tool. Apart from the selection of the sources in the system, the only thing that remains to be done by the employer is the indication of the distance between the selected source and the working place. The system consists of a database including distance depending exposure data from different sources (2 in Figure 1). For this purpose both electric and magnetic field strengths were measured at several distances from each source. This body of information is used to calculate the exposure exponent from each source describing the individual exposure decay of each source. This exponent is then used to calculate the exposure at arbitrary distances from the source. Equation 1 describes the formula needed to calculate exposure (e.g. electric field strength) at arbitrary distances.

$$E(r) = E(1m) * x^n \quad (1)$$

E (1m)	Exposure at 1m distance from the source
E(r)	Exposure at arbitrary distances from the source
x	Distance between source and location of exposure
n	Exponent describing the decay of exposure versus distance

Exposure data versus distance and limits are used to describe the decay of the exposure quotients versus distance. The administrator (1 in Figure 1) is a software tool that allows to a limited number of experts to put source data into the EMES system. The source specific exposure quotient (relation between exposure data and specific limit) at a distance of 1m and the exposure quotient is then calculated for each source and put into the database (2). Figure 1 describes this process schematically. The software (3 in Figure 1) allows the combination from an

arbitrary number of sources and calculates a total exposure quotient according to the summation formulas given in the Directive 2004/40/EC [1].

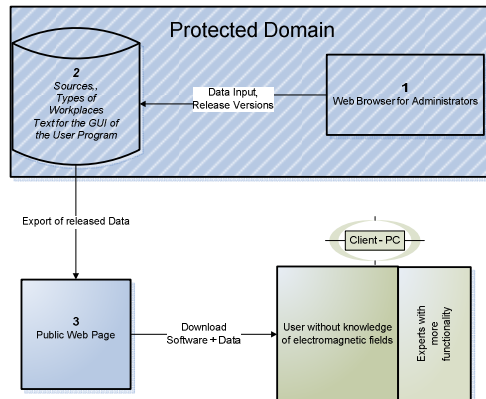


Figure 1: Software Architecture of EMES

The software system EMES allows therefore a conservative estimation of the exposure of workplaces with sources included in the EMES database. The EMES software is available in the Web and can be downloaded on the client PC.

### 3. Results

So far, exposure data from about 1.000 electromagnetic sources are included in the EMES database. The exposure arising from an arbitrary combination of these sources can be evaluated for any working place. The only information needed from the employer is the knowledge of the type of electromagnetic source and the distance between source and working place. Figure 2 is a screenshot of the user interface of EMES allowing the selection of specific electromagnetic sources. In Figure 2 two electromagnetic sources were selected, a computer at a distance of 1m, and a computer screen at a distance of 0.4m. The exposure quotients both for the general public and workers are both indicated, i.e. about 0.02 and 0.003, respectively. The selected limits are from an Austrian pre-standard, but are exactly the same as these given in the Directive 2004/40/EC.

### 4. Conclusion

A software system called EMES was developed allowing employers to evaluate exposure of the workers without any specific knowledge of the electromagnetic properties of the sources. This procedure is very efficient in term of time consumption and reliable due to the fact, that all sources at a working place can be considered for an evaluation making an underestimation of the exposure almost

Arbeitsplatz		Feldquellen	Auswertung	Feldquellentypen hinzufügen
Norm	Ergebnis	Expositionsquotient	Dominante Feldquelle	
EMSD-Berufliche Exposition (Ausg...	OK	0,00365	Bildschirme: 01-DELL 2208WFP HK...	
EMSD-Allgemeinbevölkerung (Ausg...	OK	0,02043	Bildschirme: 01-DELL 2208WFP HK...	
Vorhanden	Kategorie	Type	Entfernung [m]	Nähere Bezeichnung
<input type="checkbox"/>	Basisstationen	Basisstationenauswahl		
<input type="checkbox"/>	Beleuchtungskörper	Beleuchtungskörperauswahl		
<input checked="" type="checkbox"/>	Bildschirme	01-DELL 2208WFP	0,4	
<input type="checkbox"/>	Bluetooth Anwendungen	Bluetooth Anwendungen		
<input checked="" type="checkbox"/>	Computer	02-DELL 17570	1	
<input type="checkbox"/>	Drucker	DruckerAuswahl		
<input type="checkbox"/>	Kabelkanäle (Achtung, ...)	Kabelkanäleauswahl		
<input type="checkbox"/>	Kopierer	KopiererAuswahl		
<input type="checkbox"/>	Mobiletelefone	MobiletelefonAuswahl		
<input type="checkbox"/>	Scanner	ScannerAuswahl		
<input type="checkbox"/>	Schnurlostelefone	SchnurlostelefonAuswahl		
<input type="checkbox"/>	WLAN Anwendungen	WLAN AnwendungenAuswahl		
Hinweis! Bei mehreren gleichartigen Feldquellen (z.B.: 5 Drucker) wird jede berücksichtigt, bei Mobiltelefonen jedoch nur das mit der...				
<input type="button" value="Feldquelle hinzufügen"/>		<input type="button" value="Ergebnis drucken"/>		

Figure 2: User Interface of EMES

impossible, as long as sources and distances were correctly indicated. Summarising EMES offers:

- Reliable evaluation of working places conform to the requirements of the Directive 2004/40/EC based on sound exposure assessments instead of any estimations
- An easy to use, open system allowing exposure evaluation without any expertise in the domain of electromagnetic fields – the system is flexible and can be continuously extended by new sources
- Legal certainty of the employer based on a conservative and complete working place evaluation

In follow-up steps the extension of the electromagnetic source database and also an extension of the available standards, guidelines or other documents with exposure limits are planned.

## 5. References

1. EMF-Workers Directive 2004/40/EG (2004), Official Journal L 184, 24.5.2004, p. 1-9
2. Consultation of Social Partners, C(2010)3250 final, 20.5.2010
3. EVAL, [http://www.eval.at/EVAL\\_CMS/emes/emesstart.aspx](http://www.eval.at/EVAL_CMS/emes/emesstart.aspx), 22.2.2011

## 6. Acknowledgements

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